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THESIS

MARGINAL COST OF TRAINING A
NAVAL FLIGHT OFFICER

by

William C. Johnson

December 1990

Thesis Advisor William Gates

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Marginal Cost of Training a Naval Flight Officer

by

William C. Johnson
Lieutenant Commander, United States Navy
B.S. Illinois State University, 1976

Submitted in partial fulfillment of the
requirements for the degree of

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Author: [redacted]
William C. Johnson

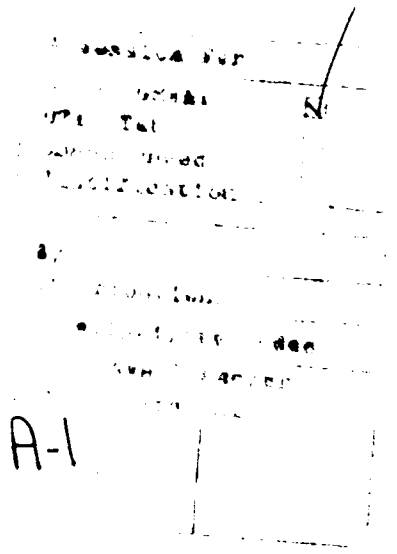
Approved by: [redacted]
William Gates, Thesis Advisor

[redacted]
Mark Eitelberg, Second Reader

[redacted]
David R. Whipple,
Chairman, Department of Administrative Sciences

ABSTRACT

This study was conducted to determine the marginal cost of training Category I and II Naval Flight Officers. Marginal costs are those costs incurred by training one additional or one less Naval Flight Officer and include undergraduate flight training, permanent change of station, and graduate flight training costs. Category I marginal costs range from $51,244.30 for a P-3 Naval Flight Officer to $309,833.36 for an A-6 Naval Flight Officer. Category II marginal costs range from $24,950.02 for a P-3 Naval Flight Officer to $155,782.71 for an A-6 Naval Flight Officer. An additional study of incremental costs will be required to fully evaluate the financial impact of a large change in the Naval Flight Officer training rate.



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I. INTRODUCTION

The only available estimate of Naval Flight Officer (NFO) training cost is based on average total cost, which includes both fixed and variable costs. Fixed costs, such as operating costs of bases and runways, will not vary with the quantity of students being trained. Variable costs, such as jet fuel for training flights and student pay, depend directly upon the volume of students.

This thesis attempts to estimate the marginal cost of training a Naval Flight Officer. Marginal cost reflects the cost of training one more NFO, or the cost savings of training one less. Marginal cost is composed of variable costs only; there is no proration of fixed costs.

The financial impact of changing the NFO training rate by one student can best be estimated by calculating the marginal cost. If average total cost was used as the base for estimating this impact, the cost (or cost saving) would be dramatically overstated.

A. EXISTING NFO COST DATA

The Chief of Naval Operations (CNO) calculated the cost of training both pilots and NFOs and presented the results in a memorandum to the Office of Legislative Affairs dated 28 July 1989. This single document represents the only NFO training cost estimate from commissioning to qualification in an

operational fleet aircraft. These data are considered to be "Taxpayer Cost to Train" and are directly related to the average total cost. Average total cost is obtained by calculating all costs, including support costs, and dividing by the number of students. The CNO estimate includes all overhead for both the training command and the Fleet Replacement Squadrons (FRS).

The Chief of Naval Education and Training (CNET) meticulously maintains NFO undergraduate flight training costs. Undergraduate NFO flight training is the initial phase where the student learns basic aviation skills. The CNET costs are delineated into 52 line items and include all costs, including a prorated share of all overhead [Ref. 1]. Graduate flight training is conducted at Fleet Replacement Squadrons and is designed to teach aircraft-specific principles. Upon completion of graduate flight training, the NFO is qualified to perform in a fleet aircraft and is normally then assigned to an operational squadron. Each FRS maintains its own cost data.

Most aviation training cost studies focus on the pilot. The Congressional Budget Office conducted a study to estimate the cost of increased aviator incentive programs designed to increase retention [Ref. 2]. NFOs are included in the incentive programs, but no training cost analysis is conducted. A staff member of the Senate Armed Services Committee stated that the cost of training pilots and NFOs was

so high that a cost-benefit analysis was not required because the benefits of increased retention obviously outweigh the cost of the bonus program [Ref. 3]. In testimony concerning the Aviation Career Incentive Improvement Act of 1989, approximate pilot training costs were considered and NFO training costs were not. The Act was passed as part of the Defense Appropriations Bill and included increased benefits for pilots and NFOs.

The most current and comprehensive cost study of aviator training costs, The Cost of Pilot Training by Morrissey and Cylke, was published by the Deputy Chief of Naval Operations for Manpower, Personnel and Training (OP-13) in March 1990 [Ref. 4]. This study utilized the marginal cost concept--i.e., the cost of training one more pilot. Very detailed cost data were obtained from CNET, and marginal costs were extracted. Due to the less detailed FRS cost data, the proportion of marginal costs to total average costs of the CNET data was used to calculate the FRS total average cost estimates based on FRS marginal costs. OP-13G was considering a similar cost study for NFO training costs and is sponsoring this thesis.

B. SCOPE OF THE STUDY

This thesis estimates the marginal cost of training a Naval Flight Officer (NFO) in the following Navy aircraft: F-14, A-6, EA-6, S-3, E-2, and P-3. Marginal cost calculations commence with the first day of Aviation Preflight

Indoctrination through completion of the respective Fleet Replacement Squadron (FRS). These cost calculations are made to assess the financial impact of one more or one less student trained. To use these results to estimate the financial impact of a larger change in the NFO training rate would not be appropriate, as the methodology of this study does not address changes in fixed costs that would accompany a large change in the NFO training rate. Marginal cost is calculated for an "average" student, a newly commissioned ensign with typical characteristics, as described in Chapter III.

C. ORGANIZATION

This study provides an overview of the NFO training process in Chapter II, the methodology and assumptions in Chapter III, and conclusions and recommendations in Chapter IV.

II. BACKGROUND

A. UNDERGRADUATE FLIGHT TRAINING

Undergraduate flight training is designed to teach the basic skills of aviation, communication, and navigation to the student Naval Flight Officer (NFO). These skills are general in nature and not tailored to any specific aircraft.

All student NFOs commence training at Pensacola, Florida, with Aviation Preflight Indoctrination. Jet aircraft (F-14, A-6, EA-6, and S-3) student NFOs complete all undergraduate training at Pensacola. Propeller-driven aircraft (E-2 and P-3) student NFOs complete the initial phase of undergraduate training at Pensacola and are transferred to other commands to complete this basic training.

B. GRADUATE FLIGHT TRAINING

Graduate flight training is conducted at the Fleet Replacement Squadrons. There are four categories of flight training--CAT I, II, III, and IV. CAT I NFO training is the first advanced training in a specific aircraft; CAT II is refresher training normally for officers returning to the squadron as department heads; CAT III is for commanding and executive officers; and CAT IV is for others, such as foreign students.

Upon completion of undergraduate flight training, the newly designated Naval Flight Officers are transferred to

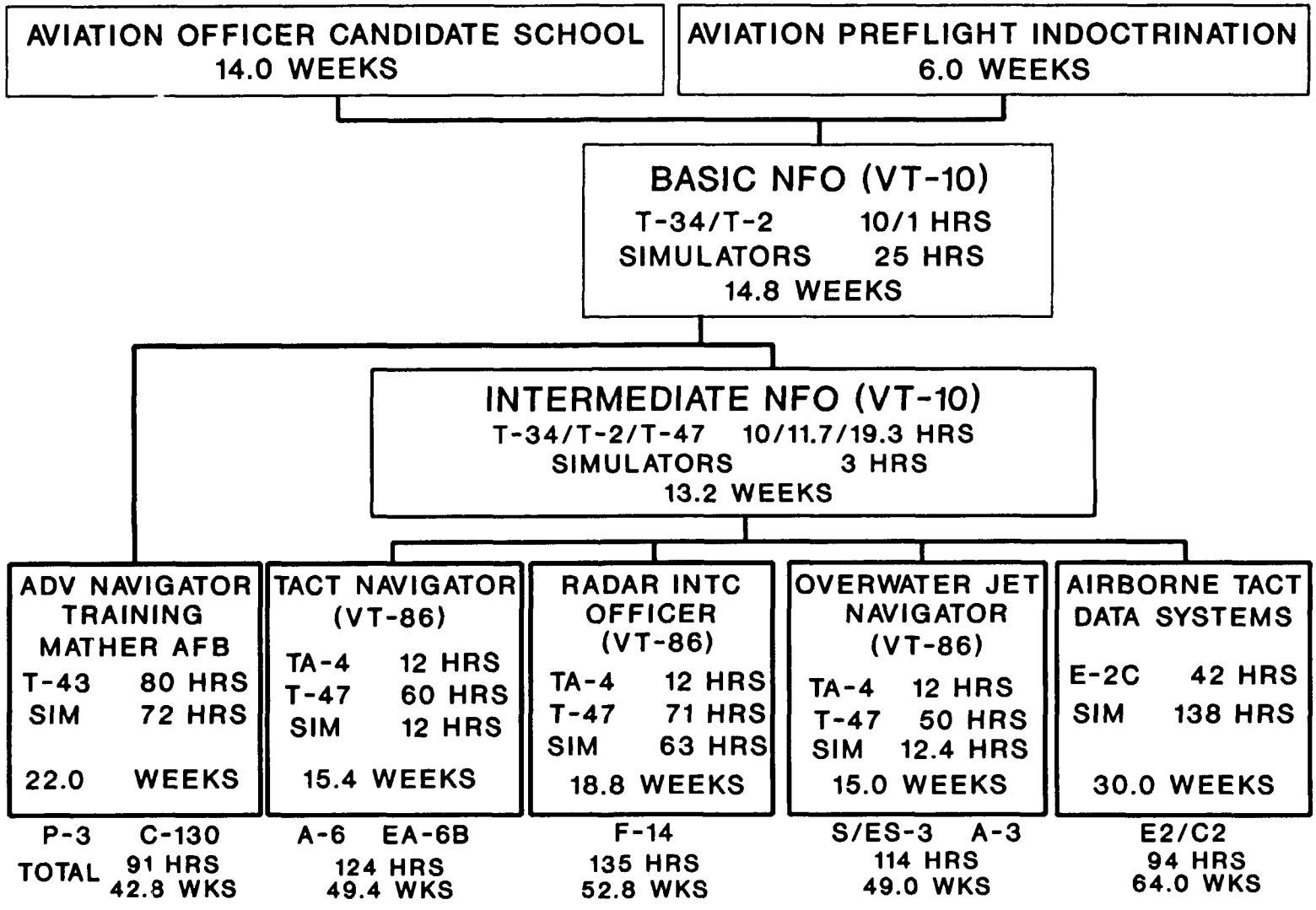
Fleet Replacement Squadrons for CAT I training. This aircraft-specific training qualifies the NFO for assignment to an operational squadron in the fleet.

C. CATEGORY I TRAINING PIPELINE

The Category One (CAT I) training pipeline, for the purposes of this study, includes undergraduate and graduate flight training. This training commences with the first day of Aviation Preflight Indoctrination and concludes with completion of training at the respective Fleet Replacement Squadron. The training necessary for a student to become qualified in a specific Navy aircraft, or training "pipeline," is described in detail. Figure 1 depicts this pipeline.

1. F-14

The Radar Intercept Officer (RIO) receives all his undergraduate training at Pensacola, Florida. Upon completion of Aviation Preflight Indoctrination, the RIO enters Basic NFO training at VT-10. This is the first selection point for the RIO, as P-3 selectees are transferred to Mather Air Force Base. The next step is Intermediate NFO training, also at VT-10. The final selection point for the RIO occurs upon completion of this phase, and the RIO enters RIO training at VT-86. Undergraduate training is complete at the end of RIO training, when the RIO is designated an NFO, awarded wings,



Source: CNET

Figure 1

Undergraduate Naval Flight Officer Programs

and transferred to one of two Fleet Replacement Squadrons located at NAS Miramar, California, and NAS Oceana, Virginia, to commence graduate flight training.

2. **A-6 and EA-6**

This pipeline is similar to that of the F-14 RIO, except the student NFO is assigned to Tactical Navigator training at VT-86. Upon completion of this phase, the student is designated an NFO, awarded wings, selected for A-6 or EA-6, and transferred to the appropriate FRS. EA-6 NFOs are assigned to Whidbey Island, Washington, and A-6 NFOs may be assigned to either Whidbey Island or Oceana, Virginia.

3. **S-3**

The Tactical Coordinator (TACCO) pipeline is also similar to that of the RIO. After completion of Intermediate NFO training, the student is selected for S-3 and attends Overwater Jet Navigator training at VT-86. Upon completion, the TACCO is designated an NFO, awarded his or her wings, and transferred to one of two S-3 FRSs at NAS North Island, California, or NAS Cecil Field, Florida.

4. **E-2**

The E-2 student NFO departs Pensacola after completing Intermediate NFO training at VT-10 and goes directly to the FRS for completion of Airborne Tactical Data Systems. Half-way through the FRS curriculum, he or she is designated an NFO and awarded his wings.

5. **P-3**

The P-3 Tactical Coordinator (TACCO) is the quickest student NFO to depart Pensacola. Upon completion of Basic NFO training at VT-10, the TACCO is transferred to Mather Air Force Base, California, to complete Advanced Navigator Training. Upon completion, the TACCO is designated an NFO, awarded wings, and is transferred to an FRS at NAS Jacksonville, Florida, or NAS Moffett Field, California.

III. METHODOLOGY

A. MARGINAL COST CONCEPT

The marginal cost of training one more NFO is derived by tracking a theoretical additional student through every phase of instruction and determining which activities would produce additional expense. Activities that produce additional expense are categorized as variable costs and are allocated to this theoretical student as marginal costs. Activities that do not produce additional expense are categorized as fixed costs and are not allocated. Four sources of marginal costs have been identified: student salary, undergraduate flight training, Permanent Change of Station (PCS) Moves, and Fleet Replacement Squadron training.

1. Student Salary

Every student is paid a salary. The amount is calculated by totalling pay and allowances for an "average" student in the respective category of training. An "average" CAT I student is determined to be an ensign with less than two years of active service. Basic Allowance for Subsistence (BAS) is paid to all officers at the same monthly rate. Basic Allowance for Quarters (BAQ) and Variable Housing Allowance (VHA) depend on rank and whether or not the officer has dependents. The dependent status was determined by assuming the student has the same number of dependents as calculated by

the Defense Manpower Data Center (DMDC), Monterey, California, of all NFO-designated ensigns based on the June 1990 Officer Master File. An "average" CAT II student is determined to be a Lieutenant Commander, with over ten years of active duty and the DMDC-calculated average number of dependents. The F-14, A-6, S-3, E-2, and P-3 communities operate two Fleet Replacement Squadrons each. VHA is averaged between both locations for each community, as each FRS is assigned approximately one-half of the students in the respective community. There is only one EA-6 FRS, at Whidbey Island, so there is no need to use average VHA.

2. **Undergraduate Flight Training**

The marginal cost for undergraduate flight training includes aircraft fuel, initial flight gear issue, expended instructional materials, and the extensive pre-flight physical. The civilian maintenance contract on all Pensacola Navy aircraft is determined to be a long-term fixed cost, as this multi-year contract is paid on a yearly basis, not on number of hours flown. There is sufficient slack in the current contract that the additional hours required to train another student will not increase the yearly cost of the maintenance contract. The fact that the increased flight hours will result in a lower average total cost per flight hour has absolutely no bearing on marginal cost. Fuel costs for the Navy aircraft, including the T-34, T-2, and TA-4, are considered marginal, as aircraft capacity is one student NFO

and additional flights would be required to train an additional student.

All T-47 civilian pilot and maintenance costs are also considered long-term fixed costs, as these services are included in a multi-year contract which stipulates the availability for the Navy to fly 17,000 flight hours per year. Even if the Navy does not utilize all 17,000 flight hours, they are paid for. The current contract expires in October 1991, and contractual details for the new contract are not available at this time. If the contract allows payment for actual hours flown, then those costs will become marginal. Fuel costs for the T-47 aircraft are considered fixed costs, as one additional student can be trained without requiring additional flights. The aircraft has the capacity to carry three students, although some training missions dictate a maximum of two students. The goal to fly all 17,000 flight hours, which are paid for, allows the Navy to fly less than the maximum capacity of students per flight. An increase in the number of students per flight would result in higher efficiency, not higher cost. The Navy's utilization of T-47 flight time was 16,903 hours in FY 87, 14,655 hours in FY 88, 16,163 hours in FY 89, and 17,000 hours in FY 90. [Ref. 5]

3. **PCS Moves**

All Permanent Change of Station (PCS) moves are marginal costs, as any additional student will ultimately be required to move from Pensacola to the respective FRS. These

costs include Household Goods (HHG) weight allowance, travel expenses for the officer and his average number of dependents, and Dislocation Allowance (DLA). These costs are calculated using the average number of dependents determined by Defense Manpower Data Center statistics. The F-14, A-6, S-3, E-2, and P-3 communities operate two Fleet Replacement Squadrons each. There is only one EA-6 Fleet Replacement Squadron. To calculate PCS cost where two FRSs exist, an average of the two possible locations is used, as each FRS is assigned approximately one-half of total students for each community.

4. **Fleet Replacement Squadron Training**

Marginal costs include aircraft operating cost, additional flight gear for carrier-based aircraft NFOs, and expended instructional materials. The largest cost item is aircraft operating cost, which is calculated at the "operating cost to fleet" rate. This rate includes fuel, oil, parts, and all maintenance. This methodology differs from the Pensacola aircraft because this cost is based on the actual number of flight hours flown, not a yearly cost.

B. CATEGORY I COST DATA BY AIRCRAFT (FY-89)

1. F-14

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Avg months in trng = 12.4 undergrad + 12.4 grad = 24.8 months

Salary Item		Subtotal	Total
1. Base Pay = $1338.90 x 24.8 months	=	$ 33,204.72	
2. BAS = $119.61 x 24.8 months	=	$ 2,966.33	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
Defense Manpower Data Center (DMDC) determined that of all NFO-designated ensigns listed on the Officer Master File in June 1990, **63.1%** have no dependents and **36.9%** have dependents.			
(.631 x 268.80) + (.369 x 364.50) = $304.11 304.11 x 24.8 months	=	$ 7,541.93	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Pensacola VHA = (.631 x 7.61) + (.369 x 10.32) = $8.61 8.61 x 12.4 months	=	$ 106.76	
Avg FRS VHA = (Norfolk VHA + San Diego VHA) / 2			
--Norfolk VHA = (.631 x 91.91) + (.369 x 124.63) = 103.98 --San Diego VHA = (.631 x 174.65) + (.369 x 236.83) = 197.59			
(103.98 + 197.59) / 2 = 150.79			

150.79 x 12.4 months	=	$ 1,869.80	
5. Flight Pay = $125.00 x 24.8 months	=	$ 3,100.00	
TOTAL SALARY			**$48,789.54**

b. Undergraduate Flight Training

Items		**Subtotal**	**Total**
1. Flight Operations Cost = Flt hrs x fuel cost per hr			

Acft Type	Hrs	Cost/hr	
T-34	20	21.75	
= $ 435.00			
T-2	12.7	232.88	
= $2,957.58			
TA-4	12.1	298.96	
= $3,617.42		= $ 7,010.00	

Hours were provided by CNET; fuel costs per hr provided by CNATRA.

2. Instructional Materials	=	$ 189.79	
3. Flight Gear	=	$ 1,712.81	
4. Preflight Physical	=	$ 507.56	

Data provided by CNET

TOTAL UNDERGRADUATE COSTS		**$ 9,420.16**

c. Permanent Change of Station Moves

PCS Cost = (% with no dependents x single PCS cost) + (% with dependents x with dependents PCS cost)

DMDC provided percentages of students with and without dependents; NMPC provided average PCS cost data for ensigns with and without dependents for each PCS move. There are two F-14 FRSs, one at NAS Miramar (San Diego) and another at NAS Oceana (Norfolk). PCS cost is estimated as an average cost of the two possible moves from Pensacola.

PCS Cost	Subtotal	Total
1. To San Diego (.631 x 2378.8) + (.369 x 5434.5) = $3,506.35		
2. To Norfolk (.631 x 1772.80) + (.369 x 3862.50) = $2,543.90		
AVERAGE PCS COST		**$ 3,025.13**

d. FRS Costs

FRS Item		Subtotal	Total
1. Flight Operations Average flt hrs to complete x operating cost/hr 65 x 2362	=	$153,530.00	
Hours were provided by CNET; fuel costs per hr provided by CNATRA			
2. Flight Gear	=	$ 1,232.00	
3. Expended instructional materials	=	$ 500.00	

TOTAL FRS COSTS **$155,262.00**

e. **Total F-14 CAT I NFO Marginal Cost** **$216,496.83**

2. **A-6**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Avg months in trng = 11.8 undergrad + 11.1 grad = 22.9 months

Salary Item		Subtotal	Total
1. Base Pay = $1338.90 x 22.9 months	=	$ 30,660.81	
2. BAS = $119.61 x 22.9 months	=	$ 2,739.07	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.631 x 268.80) + (.369 x 364.50) = $304.11 304.11 x 22.9 months	=	$ 6,964.12	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Pensacola VHA = (.631 x 7.61) + (.369 x 10.32) = $8.61 8.61 x 11.8 months	=	$ 101.60	
Avg FRS VHA = (Norfolk VHA + Whidbey Island VHA) / 2			
--Norfolk VHA = (.631 x 91.91) + (.369 x 124.63) = 103.98			

--Whidbey VHA = (.631 x 35.54) + (.369 x 48.19) = 40.21

(103.98 + 40.21) / 2 = 72.10
72.10 x 11.1 months = $ 800.31

5. Flight Pay = $125.00 x 22.9 months = $ 2,862.50

TOTAL SALARY **$44,128.41**

b. Undergraduate Flight Training

Items			**Subtotal**	**Total**
1. Flight Operations Cost = Flt hrs x fuel cost per hr				
Acft Type	Hrs	Cost/hr		
T-34	20	21.75		
= $ 435.00				
T-2	12.7	232.88		
= $2,957.58				
TA-4	12.1	298.96		
= $3,617.42			= $ 7,010.00	

Hours were provided by CNET; fuel costs per hr provided by CNATRA.

2. Instructional Materials = $ 176.80

3. Flight Gear = $ 1,712.80

4. Preflight Physical = $ 507.56

Data provided by CNET

TOTAL UNDERGRADUATE COSTS **$ 9,407.16**

c. **Permanent Change of Station Moves**

PCS Cost = (% with no dependents x single PCS cost) + (% with dependents x with dependents PCS cost)

DMDC provided percentages of students with and without dependents; NMPC provided average PCS cost data for ensigns with and without dependents for each PCS move. There are two A-6 FRSs, one at NAS Whidbey Island, Washington, and another at NAS Oceana (Norfolk). PCS cost is estimated as an average cost of the two possible moves from Pensacola.

PCS Costs	**Subtotal**	**Total**
1. To Whidbey Island (.631 x 2731.80) + (.369 x 6225.50) = $4,020.98		
2. To Norfolk (.631 x 1772.80) + (.369 x 3862.50) = $2,543.90		
AVERAGE PCS COST		**$ 3,282.44**

d. **FRS Costs**

FRS Item	**Subtotal**	**Total**
1. Flight Operations = Average flt hrs to complete x operating cost/hr		

Acft Type	Hrs	Cost/hr		
A-6	83	2213.00		
= $183.679.00				
TC-4C	55	1229.17		
= $ 67,604.35			=	$251,283.35

OP-59 provided average hours and TC-4C cost; OP-05 provided A-6 operating cost

2. Flight Gear	=	$ 1,232.00

3. Expended instructional materials	=	$ 500.00	
TOTAL FRS COSTS			**$253,015.35**

e. **Total A-6 CAT 1 NFO Marginal Cost** **$309,833.36**

3. **EA-6**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Avg months in trng = 12.4 undergrad + 3.0 Electronic Warfare Trng at Corry Station, Pensacola + 8.3 grad = 23.7 months

Salary Item		**Subtotal**	**Total**
1. Base Pay = $1338.90 x 23.7 months	=	$ 31,731.93	
2. BAS = $119.61 x 23.7 months	=	$ 2,834.76	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.631 x 268.80) + (.369 x 364.50) = $304.11 304.11 x 23.7 months	=	$ 7,207.41	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Pensacola VHA = (.631 x 7.61) + (.369 x 10.32) = $8.61 8.61 x 15.4 months	=	$ 132.59	

Whidbey Island VHA = (.631 x 35.54) + (.369 x 48.19)
= 40.21
40.21 x 8.3 months = $ 333.74

5. Flight Pay = $125.00 x 23.7 months = $ 2,962.50

TOTAL SALARY **$45,202.93**

b. Undergraduate Flight Training

Items			**Subtotal**	**Total**
1. Flight Operations Cost = Flt hrs x fuel cost per hr				
Acft Type	Hrs	Cost/hr		
T-34 = $ 435.00	20	21.75		
T-2 = $2,957.58	12.7	232.88		
TA-4 = $3,617.42	12.1	298.96	= $ 7,010.00	
Hours were provided by CNET; fuel costs per hr provided by CNATRA.				
2. Instructional Materials			= $ 176.80	
3. Flight Gear			= $ 1,712.80	
4. Preflight Physical			= $ 507.56	
Data provided by CNET				
TOTAL UNDERGRADUATE COSTS				**$ 9,407.16**

c. **Permanent Change of Station Moves**

PCS Cost = (% with no dependents x single PCS cost) + (% with dependents x with dependents PCS cost)

DMDC provided percentages of students with and without dependents; NMPC provided average PCS cost data for ensigns with and without dependents for each PCS move. There is one EA-6 FRS, which is located at NAS Whidbey Island, Washington.

PCS Move	**Subtotal**	**Total**
1. To Whidbey Island (.631 x 2731.80) + (.369 x 6225.50) = $4,020.98		
PCS COST		**$ 4.020.98**

d. **FRS Costs**

FRS Item	**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr		
76 hrs x $1812	= $137,712.00	
OP-59 provided average hours; OP-05 provided operating cost		
2. Flight Gear	= $ 1,232.00	
3. Expended instructional materials	= $ 500.00	
TOTAL FRS COSTS		**$139,444.00**

e. **Total EA-6 CAT I NFO Marginal Cost** **$198,075.07**

4. **S-3**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Avg months in trng = 11.7 undergrad + 7.6 grad = 19.3 months

Salary Item		Subtotal	Total
1. Base Pay = $1338.90 x 19.3 months	=	$ 25,840.77	
2. BAS = $119.61 x 19.3 months	=	$ 2,308.47	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.631 x 268.80) + (.369 x 364.50) = $304.11			
304.11 x 19.3 months	=	$ 5,869.32	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Pensacola VHA = (.631 x 7.61) + (.369 x 10.32) = $8.61			
8.61 x 11.7 months	=	$ 100.74	
Avg FRS VHA = (San Diego VHA + Jacksonville, FL VHA) / 2			
San Diego VHA = (.631 x 174.65) + (.369 x 236.83) = 197.59			
Jacksonville VHA = (.631 x 85.17) + (.369 x 115.49) = 96.36			

Avg FRS VHA = 146.98
146.98 x 7.6 months = $ 1,117.05

5. Flight Pay = $125.00 x 19.3 months = $ 2,412.50

TOTAL SALARY **$37,648.85**

b. **Undergraduate Flight Training**

Items	**Subtotal**	**Total**

1. Flight Operations Cost = Flt hrs x fuel cost per hr

Acft Type	Hrs	Cost/hr	
T-34	20	21.75	= $ 435.00
T-2	12.7	232.88	= $2,957.58
TA-4	12.1	298.96	= $3,617.42

= $ 7,010.00

Hours were provided by CNET; fuel costs per hr provided by CNATRA.

2. Instructional Materials = $ 174.40

3. Flight Gear = $ 1,712.80

4. Preflight Physical = $ 507.56

Data provided by CNET

TOTAL UNDERGRADUATE COSTS **$ 9,404.76**

c. **Permanent Change of Station Moves**

PCS Cost = (% with no dependents x single PCS cost) + (% with dependents x with dependents PCS cost)

DMDC provided percentages of students with and without dependents; NMPC provided average PCS cost data for ensigns with

and without dependents for each PCS move. There are two S-3 FRSs, one at NAS North Island (San Diego) for the S-3A and one at NAS Cecil Field (Jacksonville, FL) for the S-3B. PCS cost is estimated as average cost of the two possible moves from Pensacola.

PCS Cost	**Subtotal**	**Total**
1. To San Diego (.631 x 2378.80) + (.369 x 5434.50) = $3,506.35		
2. To Jacksonville (.631 x 1352.80) + (.369 x 2910.50) = $1,927.59		
AVERAGE PCS COST		**$ 2,716.97**

d. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations = Average flt hrs to complete x operating cost/hr			
58.5 hrs x $1823	=	$106,645.50	
OP-59 provided average hours; OP-05 provided operating cost			
2. Flight Gear	=	$ 1,232.00	
3. Expended instructional materials	=	$ 500.00	
TOTAL FRS COSTS			**$108,377.50**

e. **Total S-3 CAT I NFO Marginal Cost** **$158,148.08**

5. **E-2**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Avg months in trng = 7.8 undergrad + 9.1 grad = 16.9 months

Salary Item		Subtotal	Total
1. Base Pay = $1338.90 x 16.9 months	=	$ 22,627.41	
2. BAS = $119.61 x 16.9 months	=	$ 2,021.41	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.631 x 268.80) + (.369 x 364.50) = $304.11			
304.11 x 16.9 months	=	$ 5,139.46	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Pensacola VHA = (.631 x 7.61) + (.369 x 10.32) = $8.61			
8.61 x 7.8 months	=	$ 67.16	
Avg FRS VHA = (San Diego VHA + Norfolk VHA) / 2			
San Diego VHA = (.631 x 174.65) + (.369 x 236.83) = 197.59			
Norfolk VHA = (.631 x 91.91) + (.369 x 124.63) = 103.98			

Avg FRS VHA = 150.79
150.79 x 9.1 months = $ 1,372.19

5. Flight Pay = $125.00 x
16.9 months = $ 2,112.50

TOTAL SALARY **$33,340.18**

b. Undergraduate Flight Training

Items			**Subtotal**	**Total**
1. Flight Operations Cost = Flt hrs x fuel cost per hr				
Acft Type	Hrs	Cost/hr		
T-34 = $ 217.50	10	21.75		
T-2 = $2,724.70	11.7	232.88	= $ 2.942.20	
Hours were provided by CNET; fuel costs per hr provided by CNATRA.				
2. Instructional Materials			= $ 112.20	
3. Flight Gear			= $ 664.75	
4. Preflight Physical			= $ 507.56	
Data provided by CNET				
TOTAL UNDERGRADUATE COSTS				**$ 4,226.71**

c. Permanent Change of Station Moves

PCS Cost = (% with no dependents x single PCS cost) + (% with dependents x with dependents PCS cost)

DMDC provided percentages of students with and without dependents; NMPC provided average PCS cost data for ensigns with and without dependents for each PCS move. There are two E-3 FRSs, one at NAS Miramar (San Diego) and another at NAS Norfolk.

PCS cost is estimated as average cost of the two possible moves from Pensacola.

PCS Cost	**Subtotal**	**Total**
1. To San Diego (.631 x 2378.80) + (.369 x 5434.50) = $3,506.35		
2. To Norfolk (.631 x 1772.80) + (.369 x 3862.50) = $2,543.90		
AVERAGE PCS COST		**$ 3,025.13**

d. **FRS Costs**

FRS Item	**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr		
50.0 hrs x $1606 =	$ 80,300.00	
OP-59 provided average hours; OP-05 provided operating cost		
2. Flight Gear =	$ 1,232.00	
3. Expended instructional materials =	$ 500.00	
TOTAL FRS COSTS		**$ 82,032.00**

e. **Total E-2 CAT I NFO Marginal Cost** **$122,623.97**

6. **P-3**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Avg months in trng = 4.8 Pensacola + 5.1 Advanced Navigation Training + 4.8 grad = 14.7 months

Salary Item		Subtotal	Total
1. Base Pay = $1338.90 x 14.7 months	=	$ 19,681.83	
2. BAS = $119.61 x 14.7 months	=	$ 1,758.27	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.631 x 268.80) + (.369 x 364.50) = $304.11			
304.11 x 14.7 months	=	$ 4,470.42	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Pensacola VHA = (.631 x 7.61) + (.369 x 10.32) = $8.61			
8.61 x 4.8 months	=	$ 41.33	
Mather AFB VHA = (.631 x 71.05) + (.369 x 96.35) = 80.39			
80.39 x 5.1 months	=	$ 409.99	
Avg FRS VHA = (Jacksonville VHA + Moffett Field VHA) / 2			
Jacksonville VHA = (.631 x 85.17) + (.369 x 115.49) = 96.36			
Moffett VHA = (.631 x 285.92) + (.369 x 368.87) = 316.53			
Avg FRS VHA = 206.45			
206.45 x 4.8 months	=	$ 990.96	

5. Flight Pay = $125.00 x 14.7 months = $ 1,762.50

TOTAL SALARY **$21,115.30**

b. Undergraduate Flight Training

Items	**Subtotal**	**Total**

1. Flight Operations Cost = Flt hrs x fuel cost per hr

Acft Type	Hrs	Cost/hr		
T-34	10	21.75		
= $ 217.50				
T-2	1.0	232.88		
= $ 232.88			=	$ 2,942.20

Hours were provided by CNET; fuel costs per hr provided by CNATRA.

2. Instructional Materials = $ 112.20

3. Flight Gear = $ 664.75

4. Preflight Physical = $ 507.56

Data provided by CNET

TOTAL PENSACOLA COSTS **$ 1,734.89**

c. Advanced Navigation Training at Mather AFB

Marginal cost for flight operations is considered zero due to the large capacity of students in the T-43 aircraft. On additional student would not require any additional flights.

Items		Subtotal	Total
1. Expended instructional materials	=	$ 300.00	
2. Other Gear Issued	=	$ 160.00	
TOTAL MATHER COST			**$ 460.00**

d. **Permanent Change of Station Moves**

PCS Cost = (% with no dependents x single PCS cost) + (% with dependents x with dependents PCS cost)

DMDC provided percentages of students with and without dependents; NMPC provided average PCS cost data for ensigns with and without dependents for each PCS move. There are two PCS moves required, first from Pensacola to Mather AFB, then from Mather AFB to an FRS at either Moffett Field or NAS Jacksonville.

PCS Move		Subtotal	Total
1. To Mather AFB (.631 x 2561.80) + (.369 x 5834.50)	=	$ 3,769.43	
2. Avg FRS PCS			
Moffett Field PCS = (.631 x 1229.80) + (.369 x 2709.50) = $1,775.80			
Jacksonville PCS = (.631 x 2577.80) + (.369 x 5869.50) = $3,792.43			
Avg FRS PCS cost	=	$ 2,784.11	
AVERAGE PCS COST			**$ 6,553.54**

e. **FRS Costs**

Flight operations costs are prorated for an additional NFO at one-sixth of the aircraft operating cost because all training stations (pilot, two NFOs, and three others) are normally occupied.

FRS Item		Subtotal	Total
1. Flight Operations Average flt hrs to complete x operating cost/hr / 6			
60.0 hrs x $1275 / 6	=	$ 12,760.00	
OP-59 provided average hours; OP-05 provided operating cost to the fleet cost			
2. Additional Flight Gear	=	$ 120.00	
3. Expended instructional materials	=	$ 500.00	
TOTAL FRS COSTS			**$ 13,380.00**

e. **Total P-3 CAT I NFO Marginal Cost** **$ 51,244.30**

C. CAT II NFO TRAINING COSTS

CAT II NFO graduate flight training costs consist of student salary and Fleet Replacement Squadron costs. There are no PCS or undergraduate flight training costs involved. Student salary calculations are not complicated by changing geographic locations during training, as in the case of the CAT I NFO.

1. **F-14**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Salary Item		Subtotal	Total
1. Base Pay	=	$ 2,806.60	
2. BAS	=	$ 119.61	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.109 x 502.20) + (.891 x 577.80)	=	$ 569.56	

Defense Manpower Data Center (DMDC) determined that of all NFO-designated LCDRs listed in the Officer Master File in June 1990, 10.9 % have no dependents and 89.1% have dependents.

4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)

In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:

Avg Single VHA = Average of the San Diego and Norfolk rates
(309.37 + 115.32) / 2
= 212.35.
Avg With Dep. VHA = Average of the San Diego and Norfolk rates
(355.94 + 132.67) / 2
=244.31

(.109 x 212.35) + (.891 x 244.31)	=	$ 240.83	
5. Flight Pay	=	$ 400.00	
TOTAL SALARY = $4,136.60 x 4.2 months in training	=		**$17,373.72**

b. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr			
22.0 hrs x $2362	=	$ 51,964.00	
OP-59 provided average hours; OP-05 provided operating cost			
2. Flight Gear	=	$ 437.00	
3. Expended instructional materials	=	$ 175.00	
TOTAL FRS COSTS			**$ 52,576.00**

c. **Total F-14 CAT II NFO Marginal Cost** **$ 69,949.72**

2. **A-6**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Salary Item		**Subtotal**	**Total**
1. Base Pay	=	$ 2,806.60	
2. BAS	=	$ 119.61	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.109 x 502.20) + (.891 x 577.80)	=	$ 569.56	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC			

with/without dependents data and VHA rates for the pertinent cities:

Avg Single VHA = Average of the Whidbey Island and Norfolk rates
(48.33 + 115.32) / 2
= 81.83.
Avg With Dep. VHA = Average of the Whidbey Island and Norfolk rates
(55.60 + 132.67) / 2
= 94.14
(.109 x81.83) + (.891 x 94.14) = $ 92.80

5. Flight Pay = $ 400.00

TOTAL SALARY = $3,988.57 x 5.8 months in training = **$23,133.71**

b. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr A-6 53.0 hrs x $2213 = $117,289 TC-4C 12.0 hrs x 1229 = $14,748 OP-59 provided avg hrs and TC-4C cost per hr; OP-05 provided op cost for A-6	=	$132,037.00	
2. Flight Gear	=	$ 437.00	
3. Expended instructional materials	=	$ 175.00	
TOTAL FRS COSTS			**$132,649.00**

c. **Total A-6 CAT II NFO Marginal Cost** **$155,782.71**

3. **EA-6**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Salary Item		**Subtotal**	**Total**
1. Base Pay	=	$ 2,806.60	
2. BAS	=	$ 119.61	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.109 x 502.20) + (.891 x 577.80)	=	$ 569.56	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
Whidbey Island VHA = (.109 x 48.33) + (.891 x 55.60)	=	$ 54.81	
5. Flight Pay	=	$ 400.00	
TOTAL SALARY = $3,950.58 x 5.1 months in training	=		**$20,147.96**

b. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr			
50.0 hrs x 1812	=	$ 90,600.00	
OP-59 provided avg hrs; OP-05 provided op cost			
2. Flight Gear	=	$ 437.00	
3. Expended instructional materials	=	$ 175.00	

TOTAL FRS COSTS **$ 91,212.00**

c. **Total EA-6 CAT II NFO Marginal Cost** **$111,359.96**

4. **S-3**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Salary Item		**Subtotal**	**Total**
1. Base Pay	=	$ 2,806.60	
2. BAS	=	$ 119.61	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.109 x 502.20) + (.891 x 577.80)	=	$ 569.56	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Avg Single VHA = Average of the San Diego and Jacksonville rates (309.37 + 166.39) / 2 = 237.88			
Avg With Dep. VHA = Average of the San Diego and Jacksonville rates (355.94+ 191.44) / 2 = 273.69			
(.109 x 237.88) + (.891 x 273.69)	=	$ 269.79	
5. Flight Pay	=	$ 400.00	

TOTAL SALARY = $4,165.56 x 4.1 months in training = **$17,078.80**

b. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr			
45.0 hrs x 1823 OP-59 provided avg hrs; OP-05 provided op cost	=	$ 82,035.00	
2. Flight Gear	=	$ 437.00	
3. Expended instructional materials	=	$ 175.00	
TOTAL FRS COSTS			**$ 82,647.00**

c. **Total S-3 CAT II NFO Marginal Cost** **$ 99,725.80**

5. **E-2**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Salary Item		**Subtotal**	**Total**
1. Base Pay	=	$ 2,806.60	
2. BAS	=	$ 119.61	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.109 x 502.20) + (.891 x 577.80)	=	$ 569.56	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			

In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:

Avg Single VHA = Average of the San Diego and Norfolk rates
(309.37 + 115.32) / 2
= 212.35.
Avg With Dep. VHA = Average of the San Diego and Norfolk rates
(355.94 + 132.67) / 2
=244.31
(.109 x 212.35) + (.891 x 244.31) = $ 240.83

5. Flight Pay = $ 400.00

TOTAL SALARY = $4,136.60 x 1.8 months in training = **$ 7,445.88**

b. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr			
11.0 hrs x 1606 OP-59 provided avg hrs; OP-05 provided op cost	=	$ 17,666.00	
2. Flight Gear	=	$ 437.00	
3. Expended instructional materials	=	$ 175.00	
TOTAL FRS COSTS			**$ 18,278.00**

c. **Total E-2 CAT II NFO Marginal Cost** **$ 25,723.88**

6. **P-3**

a. **Student Salary** = (Base Pay + BAS + BAQ + VHA + Flight Pay) x average months in training

Salary Item		**Subtotal**	**Total**
1. Base Pay	=	$ 2,806.60	
2. BAS	=	$ 119.61	
3. BAQ = (% with no dependents x single BAQ rate) +(% with dependents x with dependent BAQ rate)			
(.109 x 502.20) + (.891 x 577.80)	=	$ 569.56	
4. VHA = (% with no dependents x single VHA rate) + (% with dependents x with dependents VHA rate)			
In addition, VHA varies with geographic area; using DMDC with/without dependents data and VHA rates for the pertinent cities:			
Avg Single VHA = Average of the Moffett and Jacksonville rates (403.72 + 166.39) / 2 = 285.06.			
Avg With Dep. VHA = Average of the Moffett and Jacksonville rates (478.12 + 191.44) / 2 =334.78			
(.109 x 285.06) + (.891 x 334.78)	=	$ 329.36	
5. Flight Pay	=	$ 400.00	
TOTAL SALARY = $4,225.13 x 4.0 months in training	=		**$16,900.52**

b. **FRS Costs**

FRS Item		**Subtotal**	**Total**
1. Flight Operations Average flt hrs to complete x operating cost/hr / 6			
35.0 hrs x 1275 / 6 OP-59 provided avg hrs; OP-05 provided op cost	=	$ 7,437.50	
2. Flight Gear	=	$ 437.00	
3. Expended instructional materials	=	$ 175.00	
TOTAL FRS COSTS			**$ 8,049.50**

c. **Total P-3 CAT II NFO Marginal Cost** **$ 24,950.02**

D. ASSUMPTIONS

Several broad assumptions have been made in calculating NFO marginal training costs. It is virtually impossible to accurately determine every cost that may be affected by the addition or deletion of one student. The aviation training environment is inherently dynamic, since many variables generate random effects. For example, clear weather allows many training flights to be completed, which would tend to reduce the average time to complete training. Inclement weather causes training flights to be delayed, which would tend to increase the average time to complete training. Other such variables include illness of students and instructors, dramatic changes in student class size, aircraft problems, and luck.

For the purposes of this study, the training environment is considered to be stable and predictable. There are three specific assumptions: there is flexibility in the utilization rates of the fixed assets at all phases of training; the costs of existing assets, facilities, and training personnel are fixed; and an average student will complete training in the average time.

1. **Fixed Asset Utilization Rates**

It is assumed that there is flexibility in the utilization rates of the fixed assets at every phase of training. There are no "pools" of students waiting to complete a training evolution, and an additional student will not create the requirement to change the current configuration of classrooms, instructors, pilots, aircraft, etc. The use of average completion times versus scheduled completion times may account for current normal training delays or accelerations to some degree.

The concept of flexible capacity utilizations is most predominant in the marginal cost estimate of undergraduate flight training. Specifically, the contracted costs of the Cessna T-47 aircraft, which include the civilian pilots and maintenance, are considered to be fixed costs, not marginal costs. The logic behind this assumptions is the multi-year contract which stipulates the availability for the Navy to fly 17,000 flight hours per year. The Navy pays for all 17,000 flight hours even if they are not flown. An additional student

will not cause an increase in this cost unless additional flights would cause the flight hour requirements to exceed 17,000. Conversely, a decrease in the number of students would not decrease this cost, because the flight hours are already paid for. Table 1 indicates that additional students would not cause the flight hour requirement to exceed 17,000, as long as the increase in students is not too large.

Although all contracted hours were flown in FY 90, there was flexibility to train more students without exceeding 17,000 flight hours. Student capacity per training flight is two or three, depending on the type of training mission. It was not an uncommon occurrence to fly training missions with vacant training seats, particularly near the end of the fiscal year. [Ref. 6]

TABLE 1

ANNUAL T-47 FLIGHT HOURS UTILIZED BY FISCAL YEAR
1987-1990

Fiscal Year	Flight Hours
1987	16,903
1988	14,655
1989	16,163
1990	17,000

Source: Program Manager for Cessna T-47 Program

The flexible capacity assumption for classroom instruction is valid until maximum capacity is reached, at which point additional facilities and instructors would be required. Conversely, a smaller class size would not result in cost

savings unless class size decreased to zero. Neither extreme is predicted. There are 24 undergraduate classes convened every year, and class size ranges from eight to 36 students per class, with a maximum class size of 38 students [Ref. 6].

2. **Fixed Costs**

All aircraft, facilities, equipment, and training personnel are considered fixed costs. Aircraft operating costs are categorized as fixed or marginal costs depending on the cost basis. Some short-term fixed costs are variable in the long run if they can be adjusted to meet a change in training requirements. These fixed costs are described in more detail.

a. **Aircraft**

The number of aircraft at all of the training commands will not vary with small changes in the student training rate, and are therefore considered to be fixed in the short run. In the long run, some commands have the alternative of increasing or decreasing the number of aircraft due to a different student training rate. The multiple seat training aircraft used for a large portion of undergraduate flight training may be considered a fixed cost in the long run. The current contract for the Cessna T-47 aircraft is an eight-year contract providing the aircraft, civilian pilots, and maintenance for 17,000 flight hours per year. If the Navy utilizes less than 17,000 flight hours, there is no reduction in cost. The option to fly more than 17,000 flight hours was never seriously contemplated by the Navy due to the exorbitant cost

[Ref. 5]. This contract expires at the end of FY 91, and a new contract with similar terms for the Saberliner aircraft is anticipated.

The Navy owns the T-34, T-2, and TA-4 aircraft used for undergraduate flight training. These aircraft are flown by military instructors, but the maintenance is performed by a civilian contractor. The civilian maintenance is contracted on a yearly basis, not on number of hours flown. A change in the number of student NFOs would change the number of flights required, but the yearly maintenance cost would be unchanged. Therefore, since each of these two-seat Navy aircraft can provide training for one student NFO per flight, the only marginal cost is for fuel.

The Navy owns and maintains the aircraft at the Fleet Replacement Squadrons. The operating cost of the aircraft includes fuel and all maintenance. It is prorated to the number of flight hours flown. Therefore, the operating cost-per-hour reflects the marginal cost. If a training flight is solely dedicated to training one NFO, the entire cost is charged. If multiple student training is conducted on a flight, and flights normally have no vacant NFO training seats, a prorated portion of the flight costs are charged. If multiple student training is conducted on a flight, and there is sufficient capacity to train more students concurrently, then zero cost is charged.

b. **Facilities and Equipment**

All facilities and equipment costs are assumed to be fixed, at least in the short run. In the long run, some facilities and equipment costs may be variable. Aircraft system trainers which are not being utilized for syllabus training may be used by other students for practice, or by personnel from other squadrons. For the purpose of this study, a small change in the NFO training rate is assumed to have a negligible effect on these fixed costs, so zero marginal cost is charged. A larger increase in the NFO training rate may require expansion in the long run. A decrease in the rate may result in selling surplus equipment, or at least reducing costs by terminating maintenance or canceling contracts and rental agreements when possible.

c. **Personnel**

The cost of personnel is assumed to be fixed in the short run. In the long run, some adjustments can be made in the number of instructors and support staff to accommodate a permanent change in the NFO training rate. Civilian pilots and maintenance personnel are included in the civilian contracts. These costs may or may not be variable in the long run, depending on the terms of the contracts. Military instructors and support staff are paid salary, not a per-hour or per-student rate, so the short-term effect of a change in the NFO training rate will be reflected in workload, not cost.

3. Average Student Will Complete in Average Time

The average CAT I NFO is defined as an ensign with less than two years of active service. The number of dependents, that determines the amount of BAQ, VHA, and PCS moving costs, was calculated by the Defense Manpower Data Center, Monterey, California. This was calculated by determining the number of dependents of all NFO ensigns (1320 or 1325 designator) who were included in the June 1990 Officer Master File. It is assumed that the student had this number of dependents from the beginning of training, and no changes in dependent status occurred during training.

The average CAT II student is defined as a Lieutenant Commander with between ten and 12 years of active duty service. By assumption, the student is not receiving the Aviation Officer Continuation Pay bonus and has the DMDC calculated average number of dependents for NFO Lieutenant Commanders.

It is also assumed that the average student in both categories will complete training in the FY 89 average completion times. Thus, the marginal cost estimates calculated above are expected cost estimates, based on data for FY 89.

These marginal cost estimates represent specific point estimates, with no range or confidence intervals provided. Further statistical analysis would be required to calculate an expected marginal cost, standard deviation, and confidence intervals. Actual data from previous years would be required for this analysis, but this data is not readily available and

would be extremely difficult to calculate. Although this additional analysis would help illuminate the degree of confidence and provide a predicted range, this analysis is beyond the scope of this thesis.

E. LIMITATIONS

This study specifically estimates the marginal cost of training just one more or one less Naval Flight Officer. Two problems will occur by attempting to calculate the marginal cost of a large change in the NFO training rate using these estimates. The first occurs when the average time to complete training changes. A large influx of students will undoubtedly cause "pools" of students waiting to complete training evolutions, resulting in a longer time to complete training. A large decrease in the number of students will mean more assets per student, resulting in a shorter time to complete training. The second and more dramatic impact will be the effect of incremental costs. When repeatedly adding or subtracting students, some fixed costs will become variable and change. Expansion to accommodate more students is costly. Conversely, some fixed costs will decrease once the flow of students declines to a certain point. Calculating these incremental costs is beyond the scope of this study.

V. CONCLUSIONS AND RECOMMENDATIONS

For reference, the CAT I Nd II NFO Marginal Training Costs (FY 89) estimated in Chapter III are compared with CNO estimated taxpayer cost for FY 89 and summarized in Table 2.

TABLE 2

CAT I AND II NFO TRAINING COSTS (FY 89)

Aircraft	CAT I Marg Cost	CAT II Marg Cost	CNO CAT I Taxpayer Cost
F-14	$216,496.83	$ 69,949.72	$680,800.00
A-6	$309,833.36	$155,782.71	$569,500.00
EA-6	$198,075.07	$111,359.96	$504,100.00
S-3	$158,148.08	$ 99,725.80	$469,400.00
E-2	$122,623.97	$ 25,723.88	$287,600.00
P-3	$ 51,244.30	$ 24,950.02	$102,700.00

Source for CNO data: CNO (OP-59)

The estimates of the Naval Flight Officer marginal training costs appear low in comparison with similar estimates utilizing average total cost. The basic reason these costs appear low is that the average total cost estimates include all the fixed costs associated with owning and operating all the aviation training facilities. The marginal costs only account for the costs associated with training one more or one less NFO and assume the structure of the existing fixed costs remains unchanged.

The NFO training rate is expected to decline from 587 in Fiscal 1990 [Ref. 7] to 442 in Fiscal 1991, and then stabilize at approximately 483 per year through Fiscal 1997 [Ref. 8]. The cost impact of this drastic decline in the NFO training rate will be difficult to predict. The marginal cost estimates in this study are only accurate for the decrease in the cost of training one less NFO.

One quick, but unreliable, method to predict a range of the financial impact of a dramatic decline in the training rate would be to estimate the cost savings under both the marginal cost and average total cost concepts. The marginal cost method would tend to understate the savings because it assumes all fixed costs will remain intact. The average total cost method would tend to overstate the impact because it assumes all fixed costs are variable in the short run. In other words, that a proportionate share of fixed costs would be eliminated with the reduction of the training rate. Thus, the marginal and average total cost estimates included in Table 2 give a crude approximation of the possible range of loss savings. The actual cost savings depend on the short-run variability of costs that have been categorized as fixed costs in this study.

The proper approach to determine the financial impact of the declining NFO training rate would be to conduct an incremental cost study to determine which fixed costs would be eliminated as the training rate falls. The fact that the NFO training rate is expected to significantly increase during the following year

further exacerbates this problem. Additionally, the marginal cost of training must be re-evaluated as the NFO training rate declines. These calculations are beyond the scope of this study. It is recommended that further research utilizing this approach be conducted.

LIST OF REFERENCES

1. Chief of Naval Education and Training letter to the author; Subject: Naval Flight Officer Training Costs, 16 October 1990.

2. Smith, Marvin M., "Pilot Retention in the Military: An Analysis of Alternative Bonus Plans," staff working paper, Congress of the United States Congressional Budget Office, June 1988.

3. Telephone conversation between Mr. Ken Johnson, staff member, Senate Armed Services Committee, and the author, 19 September 1990.

4. Cylke and Morrissey, The Cost of Pilot Training, Deputy CNO for Manpower, Personnel and Training (OP-13), March 1990.

5. Telephone conversation between Mr. Jack Johnson, program manager for the Cessna T-47 program, and the author, 9 November 1990.

6. Telephone conversation between LT Barnhurst, CNATRA, and the author, 13 November 1990.

7. Facsimile transmission from CTW-6 statistician to author, 15 November 1990.

8. Facsimile transmission from CNATRA to author, 13 November 1990.

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